

WHAT IS CLAIMED IS:

1. A modulation optical system for providing modulation of an incident light beam comprising:

(a) a wire grid polarization beamsplitter for receiving said beam of light, for transmitting light of said beam of light having a first polarization, and for reflecting light of said beam of light having a second polarization orthogonal to said first polarization, wherein sub-wavelength wires on said wire grid polarization beamsplitter face a reflective spatial light modulator;

(b) wherein said reflective spatial light modulator receives said polarized beam of light, having either a first polarization or a second polarization, and selectively modulates said polarized beam of light to encode data thereon, providing both modulated light and unmodulated light which differ in polarization;

(c) wherein said reflective spatial light modulator reflects back both said modulated light and said unmodulated light to said wire grid polarization beamsplitter;

(d) wherein said wire grid polarization beamsplitter separates said modulated light from said unmodulated light;

(e) a compensator is located between said wire grid polarization beamsplitter and said reflective spatial light modulator, wherein said compensator is provided for conditioning the polarization states of the oblique and skew rays of said modulated beam; and

wherein said compensator has a spatially variant retardance that corrects for a spatially variant retardance of said reflective spatial light modulator.

2. A modulation optical system as in claim 1 wherein said spatially variant retardance patterned into said compensator was created with said reflective spatial light modulator operating at a mid-level between the on and off states of said modulator.

3. A modulation optical system as in claim 1 wherein when said reflective spatial light modulator is used in combination with said compensator, a nominally spatially uniform retardance results.

4. A modulation optical system as in claim 1 wherein said spatially variant retardance patterned into said compensator is a spatially variant in-plane retardance.

5. A modulation optical system for providing contrast modulation of an incident light beam comprising:

(a) polarization optics including at least one optical polarizer and one wire grid polarization beamsplitter; wherein the sub-wavelength wires on said wire grid polarization beamsplitter face a reflective liquid crystal device;

(b) wherein said reflective liquid crystal device is provided for selectively modulating said polarized beam of light having to encode image data thereon in order to form a modulated beam, wherein said reflective liquid crystal device alters a polarization state of said incident beam of light in a controlled manner with said image data and reflects said modulated beam back to said wire grid polarization beamsplitter;

(c) a compensator, located between said wire grid polarization beamsplitter and said reflective liquid crystal device, for conditioning the polarization states of oblique and skew rays of said modulated beam; and

wherein said compensator has a spatially variant retardance that corrects for a spatially variant retardance of said reflective liquid crystal device.

6. A modulation optical system as in claim 5 wherein said spatially variant retardance patterned into said compensator was created with said reflective spatial light modulator operating at a mid-level between the on and off states of said modulator.

7. A modulation optical system as in claim 5 wherein when said reflective spatial light modulator is used in combination with said compensator, a nominally spatially uniform retardance results.

8. A modulation optical system for providing contrast modulation of an incident light beam comprising:

(a) polarization optics including a polarization beamsplitter;

(b) a reflective liquid crystal device for selectively modulating said polarized beam of light having to encode image data thereon in order to form a modulated beam, wherein said reflective liquid crystal device alters a polarization state of said incident beam of light in a controlled manner with said image data and reflects said modulated beam back to said polarization beamsplitter;

(c) a compensator, located between said polarization beamsplitter and said reflective liquid crystal device, for conditioning the polarization states of oblique and skew rays of said modulated beam; and

wherein said compensator has a spatially variant retardance that corrects for a spatially variant retardance of said reflective spatial light modulator.

9. A modulation optical system as in claim 8 wherein said spatially variant retardance patterned into said compensator was created with said reflective spatial light modulator operating at a mid-level between the on and off states of said modulator.

10. A modulation optical system as in claim 8 wherein when said reflective spatial light modulator is used in combination with said compensator, a nominally spatially uniform retardance results.

11. A modulation optical system as in claim 8 wherein said spatially variant retardance patterned into said compensator is a spatially variant in-plane retardance.

12. A spatially patterned polarization compensator, comprising an optical structure fabricated with a spatially variant retardance that corresponds to the spatially variant retardance of a spatial light modulator, such that when said patterned polarization compensator and said spatial light modulator are used in combination, a nominally spatially uniform retardance results.

13. A spatially patterned polarization compensator according to claim 12 which is fabricated with liquid crystal polymer materials.

14. A spatially patterned polarization compensator according to claim 12 which is fabricated with inorganic materials.

15. An exposure system for creating a patterned polarization compensator comprising:

- (a) a light source for providing an incident beam of light;
- (b) polarization optics including a polarization beamsplitter, for transmitting light of said beam of light having a first polarization, and for reflecting light of said beam of light having a second polarization orthogonal to said first polarization;
- (c) a polarization based reflective spatial light modulator having an undesired spatial retardance variation; wherein said modulator receives said polarized beam of light, having either a first polarization or a second polarization, and selectively modulates said polarized beam of light to encode data thereon, providing both modulated light and unmodulated light which differ in polarization;
- (d) wherein said reflective spatial light modulator reflects back both said modulated light and said unmodulated light to said polarization beamsplitter;

(e) an imaging lens which uses said modulated light to create an image of said reflective spatial light modulator onto a light-sensitive material; and

(f) wherein said light-sensitive material is exposed and patterned with variations that correlate with said undesired spatial retardance variation of said polarization based reflective spatial light modulator, thereby facilitating the fabrication of a patterned polarization compensator.

16. An exposure system according to claim 15 wherein said polarization beamsplitter is a wire grid polarizer.

17. An exposure system as in claim 15 wherein said imaging lens nominally operates at unity magnification.

18. An exposure system according to claim 15 wherein said reflective spatial light modulator is a liquid crystal device.

19. An exposure system as in claim 15 wherein said spatially variant retardance patterned into said compensator was created with said reflective spatial light modulator operating at a mid-level between the on and off states of said modulator.

20. An exposure system according to claim 15 wherein said incident beam of light is visible light.

21. An exposure system according to claim 20 wherein said light-sensitive material includes visible wavelength sensitive polymer photo-initiators.

22. An exposure system for creating a patterned polarization compensator comprising:

(a) a light source for providing an incident beam of light;

(b) polarization optics including a first polarizer for providing a polarized beam of light;

(c) a polarization based spatial light modulator having an undesired spatial retardance variation; wherein said modulator receives said polarized beam of light, and selectively modulates said polarized beam of light to encode data thereon, providing both modulated light and unmodulated light which differ in polarization;

(d) wherein said unmodulated light is removed from said modulated light by a second polarizer; and

(e) a light-sensitive material that is exposed and patterned with variations that correlate with said undesired spatial retardance variation of said polarization based spatial light modulator, thereby facilitating the fabrication of a patterned polarization compensator.

23. An exposure system according to claim 22 wherein said spatial light modulator is a liquid crystal device.

24. An exposure system according to claim 22 wherein said incident beam of light is visible light.

25. An exposure system according to claim 24 wherein said light-sensitive material includes visible wavelength sensitive polymer photo-initiators.

26. An exposure system according to claim 22 wherein an imaging lens is used to image said spatial light modulator onto said light sensitive material.

27. An exposure system as in claim 22 wherein said spatially variant retardance patterned into said compensator was created with said spatial light modulator operating at a mid-level between the on and off states of said modulator.

28. A method for fabricating a spatially patterned polarization compensator comprising :

- (a) providing a light sensitive material;
- (b) providing an incident beam of light and a polarizer to polarize said incident beam of light;
- (c) directing said incident polarized beam of light to a polarization based spatial light modulator; wherein said modulator has undesired spatial retardance variations;
- (d) directing said polarized beam of light emerging from said polarization based spatial light modulator first to a polarizer and then secondly to a target plane;
- (e) providing a light sensitive material at said target plane, wherein said light sensitive material is exposed by said polarized beam of light, so as to pattern said light sensitive material with variations that correlate with said undesired spatial retardance variations;
- (f) coating said light sensitive material with a liquid crystal polymer material, thereby creating spatial retardance variations that correlate with said undesired spatial retardance variations; and
- (g) fixing said light sensitive material by exposure with ultra-violet light.